SCDHEC *Earth Today*

Lesson Grade Level: 7

Lesson Title: Bad air in Columbia!

SC State Science Standard(s):

(III, A, 4, a) Infer how air pollution affects people and the environment.

(III, A, 4, c) Analyze ways air pollution can be reduced.

Segment Link:

Late in the first part right before the first commercial break.

Lesson Overview:

In this lesson, students will work in cooperative learning groups to analyze a city map and determine where the worst cases of ground-level ozone might occur as a result of traffic. This works best if done as a follow-up to the video segment.

Background:

Mobile sources have become one of the primary sources of air pollution in the United States. One type of air pollution created from mobile sources is known as ground-level ozone. It is ***formed*** when nitrogen oxides (pollution from car, truck and power plant emissions) and volatile organic compounds (pollution from glue, solvent and paint vapors) react with the heat and sunlight. This particular pollutant can have a negative effect on the health of humans, plants and animals. Human activities such as driving more and using more electricity have increased the amount of pollutants in the air we breathe. This type of ozone is near the ground. Ground-level ozone pollution is more of a concern during the summer months because there is an extreme amount of heat from the sun that increases the production of ground-level ozone. First and foremost, it can irritate your respiratory system, causing you to cough, have a sore throat, and even have an uncomfortable feeling in your chest. It can also make it harder for you to breathe, especially when exercising outside. People with asthma may have more serious attacks, and it can also reduce the ability of the immune system to fight infections in the respiratory system. It is also harmful to the environment. Ground-level ozone is responsible for a $1 to $ 2 billion reduction in crop yield in the United States every year. It interferes with the ability of plants to produce and store food, making them more susceptible to disease, insects, other pollutants and harsh weather.

Lesson Plan:

1. The teacher will need to get several copies of a city map. Columbia, SC would work best, though just about any large city the class is familiar with would do.
2. Split the class into three or four student cooperative groups. Each group will need to look at the system of highways and roads on the maps and decide where the highest amounts of ground-level ozone might be produced during peak traffic hours in the morning and afternoon work commutes.
3. After writing down the locations they think will be the worst, students must defend their selections in their write-ups, as well as propose alternative plans and/or routes that might alleviate the problem of having too many cars in the same stretch of road at the same time of day.

Additional Teacher Background:

What is ozone?

Ozone is a gas that occurs in the Earth's upper and lower level atmosphere. Up high in the stratosphere ozone is good, it protects us from the sun's harmful rays. Nearby in the troposphere (or ground-level), ozone is bad. Ground-level ozone is the most widely spread form of air pollution in the United States. Mobile sources cause over half of the pollution that contributes to ground-level ozone.

Good Ozone – Is a naturally occurring gas in the upper atmosphere, known as the ozone layer. This type of ozone is in the stratosphere, which is 10 to 30 miles above the Earth's surface. The good or upper ozone protects us from the sun's harmful ultraviolet rays. When you hear about the depletion of the ozone layer, the good ozone is what you are hearing about and we need to protect it.

Bad Ozone – Is also known as ground-level ozone. This type of ozone is in the lower atmosphere, the troposphere, near the ground, which is the air we breathe. Pollutants (mainly VOC's and NOX's) emitted by automobiles, power plants, chemical plants and other sources react with the heat (sunlight) and ground-level ozone is formed! Ground-level ozone pollution is more of a concern during the summer months because there is an extreme amount of heat from the sun – this causes a reaction with the air pollutants that are floating around in the atmosphere.

NOX's → Cars, Power plants, Factories

+ Heat from Sunlight = Ground-level ozone O_3

VOC's → Paints, Solvents, Glues

You can sign up to receive the ozone forecast at www.scdhec.net/baq/ozone
Ozone forecasting season is May 1st through September 31st.

Who is at risk from ground-level ozone?

Active children – They are the group that spends the most time playing outside. Children are also more likely to have asthma, which is aggravated by exposure to ozone.

Active Adults – Adults who exercise or work outside vigorously have a higher level of exposure to ozone than less active people.

People with asthma (or respiratory disease) – Their lungs are more vulnerable to effects of ozone at a much lower concentration. People with asthma could have more severe attacks than someone who does not have it.

Healthy people with unusual susceptibility – Some healthy people may experience health effects of ozone at moderate levels of exercise, no one is really sure why. Think about this – your pets breathe the same air you do!

What actions can I take to help "spare the air"?

Here are just a few examples of ways that you can begin to make a difference:

- Carpool to work or school.
- Compost yard waste instead of burning it.
- Turn off the lights, TV, computer, stereo, etc. when leaving a room.
- Ride a bike or walk to work or school.
- Stay in for lunch or have one person pick it up.
- Shop by phone or Internet.
- Mow the lawn after 6:00 PM.
- Don't top off your gas tank when refueling.